Report By:

National TAB
1329 E. KEMPER ROAD
SUITE 4210
CINCINNATI, OH 45246

NATIONAL TAB

Comfort. Under control.

Report: TAB Report
Function: Test, Adjust, & Balance
Date: 01/02/2023

PROJECT

CMS E.E. Waddell High Reno (Charlotte, NC)

730 Nations Ford Rd

Charlotte, NC 28217

Client

Action Mechanical Inc.

PO Box 7325

CHARLOTTE, NC 28241

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

Table Of Contents

CERTIFICATION

PROJECT: CMS E.E. Waddell High Reno (Charlotte, NC)

The data presented in this report is a record of system measurements and final adjustments that have been obtained in accordance with the current edition of the NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.* Any variances from design quantities, which exceed NEBB tolerances, are noted in the Test-Adjust-Balance Report Project Summary.

The air distribution system has been tested and balanced and final adjustments have been made in accordance with NEBB standards and the project specifications.

NEBB TAB FIRM: National TAB-Southeast
REGISTRATION NO: 3755
CERTIFIED BY: J. Scott Springer 23312
DATE: 1/6/2023

The hydronic distribution system has been tested and balanced and final adjustments have been made in accordance with NEBB standards and the project specifications.

NEBB TAB FIRM: National TAB-Southeast
REGISTRATION NO: 3086
CERTIFIED BY: J. Scott Springer 23312
DATE:

Submitted and Certified by:

NEBB TAB FIRM: National TAB-Southeast
TAB PROFESSIONAL: J. Scott Springer
SIGNATURE:
REGISTRATION NO: 3755 (NTAB) / 23312
CERTIFICATION EXP: 12/31/2023

National TAB - Southeast
JEFFREY S. SPRINGER
CERTIFICATION
3755
Exp. 12/31/23
Air and Hydronic Testing

Function		Range	Minimum Accuracy	Instrument Information	Calibration Date	Date Due
AIR	AIR PRESSURE	0 in wg to 10 in wg	2% +/- 0.001 in wg	Shortridge ADM 880C - S/N M05066	9/28/2022	9/28/2023
	AIR VELOCITY INSTRUMENT	50 fpm to 3900 fpm	+/- 5 % +/- 7 fpm	Shortridge ADM 880C - S/N M05066	9/28/2022	9/28/2023
	DIRECT HOOD READING	100 cfm to 2000 cfm	+/- 3 % +/- 7 cfm	Shortridge ADM 880C - S/N M05066	9/28/2022	9/28/2023
TEMPERATURE	AIR METER	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - SRH77A S/N 081820093	10/12/2022	10/12/2023
	AIR PROBE	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - PD1388 7-6 S/N 5028	10/12/2022	10/12/2023
	IMMERSION METER	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - SRH77A S/N 081820093	10/12/2022	10/12/2023
	IMMERSION PROBE	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - PD1388 7-6 S/N 1075	10/12/2022	10/12/2023
	CONTACT METER	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - SRH77A S/N 081820093	10/12/2022	10/12/2023
	CONTACT PROBE	-20 F to 240 F	+/- .5 % 2 F	Cooper ATKINS - PD1388 7-6 S/N 4011	10/12/2022	10/12/2023
HUMIDITY	HUMIDITY PROBE	10 % RH to 90 % RH	3% of reading	Cooper ATKINS - SRH77A S/N 090315046	10/12/2022	10/12/2023
ELECTRICAL	VOLTAGE MEASUREMENT	0 VAC to 600 VAC	2 % reading +/- 5 digits	Dwyer CM-1 - S/N 190800099	10/12/2022	10/12/2023
	AMPERAGE MEASUREMENT	0 Amperers to 100 Amperes	2 % reading +/- 5 digits	Dwyer CM-1 - S/N 190800099	10/12/2022	10/12/2023
ROTATION	ROTATION MEASUREMENT	60 rpm to 5000 rpm	2 % reading 2 rpm	Dwyer TAC-L - S/N S1100123	10/12/2022	10/12/2023
HYDRONIC	PRESSURE MEASUREMENT	-30 in Hg to 200 psi	±2% of reading +/- 1 psi	Dwyer 490W-6 - S/N 01L6NK	6/29/2022	6/29/2023
	DIFFERENTIAL PRESSURE MEASUREMENT	0 psi - 80 psi	±2% of reading +/- 1 psi	Dwyer 490W-6 - S/N 01L6NK	6/29/2022	6/29/2023

NEBB ABBREVIATIONS	
A = Area (ft²) IP, (m²) SI	M = Mass (lb) IP, (kg) SI
ACH = Air Changes per Hour	ma = Mixed Air
A_k = Effective Area	m = meter (metre)
AV = Average	m³/s = Volumetric Flow: Cubic Meters Per Second
BHP = Brake Horsepower (IP) HP	NLA = No Load Amperage
BP = Brake Power (SI) kW	NPSHA = Net Positive Suction Head Available
Btu = British Thermal Unit	oa = Outside Air
Btu/h = Btuh = BTUH = BTU/Hour	$\%_{oa}$ = % of Outside Air
℄ = Center Distance (used in belt formula)	Ω = Ohm
°C = Degrees Celsius, °C	P = Pressure
C = Friction Loss Coefficient (For Duct Fittings)	P_a = Atmospheric Pressure
CCF = 100 Cubic Feet	P_{ab} = Absolute Pressure (Atmospheric Pressure + Gauge Pressure)
CFM = Volumetric Flow: Cubic Feet Per Minute	Pa = Pascals, Pressure SI
C_p = Specific Heat	π = 3.14
C_v = Flow Constant (IP)	PD = Sheave Pitch Diameter
ρ = Density (lb/ft³) IP, (kg/m³) SI	$P_{℄}$ = Pressure at Pump Centerline
d = Diameter (in.) IP, (mm) SI	ppm = parts per million
Δ = Difference or Change (Final - Initial)	psi = Pounds Per Square Inch
d_{imp} = Impeller Diameter	psia = Pounds Per Square Inch Absolute
E = Volts	psig = Pounds Per Square Inch Gauge
Eff = Efficiency	P_{vp} = Absolute Vapor Pressure
EP = Pump Efficiency	Q (flow) = Volumetric Fluid Flow Rate: (i.e. CFM, GPM, m³/s, l/s, etc.)
°F = Degrees Fahrenheit, °F	Q (heat) = Heat Flow Rate (BTU/Hour) IP, (W or kW) SI
f = Friction Factor	°R = °Rankin = Degrees Rankin, °R
FLA = Full Load Amps	r = Radius (in) IP, (mm) SI
fpm = Feet per Minute (fpm)	$\%_{ra}$ = % of Return Air
ft = Foot	R = Resistance
g = Acceleration of Gravity	ra = Return Air
gal = Gallons	rad = Radians
GPM = Gallons Per Minute (GPM)	RH = Relative Humidity
h = Enthalpy (BTU/lb dry air) IP, (kJ/kg dry air) SI	RPM = Revolutions Per Minute
H = Head (in wc, ft wc, psi) IP, (Pa, kPa) SI	R_{value} = Thermal Resistance
Hg = Mercury	s = second
h_{ma} = Mixed Air Enthalpy	SHR = Sensible Heat Ratio
h_{oa} = Outside Air Enthalpy	SME = Sash Movement Effect Performance Rating (SME-XX yyy)
HP = Horsepower	SP = Static Pressure
hr = Hour	Sp Gr = Specific Gravity (for water use 1.00)
h_{ra} = Return Air Enthalpy	T = Temperature
HT = Height (in) IP, (mm) SI	Ta = Absolute Temperature (460˚ + T) or °R
I = Amps	T_{ma} = Mixed Air Temperature
J = Joules	T_{oa} = Outside Air Temperature
K = Kelvin, K	TP = Total Pressure
K_v = Flow constant (SI)	T_{ra} = Return Air Temperature
kg = Kilogram	TS = Tip Speed (fpm) IP, (m/s) SI
kJ = Kilojoule	U = Heat Transfer Coefficient
kPa = Kilopascal	μ = viscosity, dynamic
kW = Kilowatt = 1000 Watts	V = Velocity
l = Liter (Litre)	VP = Velocity Pressure
l/s = Volumetric Flow: Liters Per Second	W = Watt
lb = Pounds	WD = Width (in) IP, (mm) SI
lm = Lumens	wg = wc = water gauge = water column
ln = natural log	WHP = Water Horsepower (IP)
LG = Length (in) IP, (mm) SI	WP = Water Power (SI)
lx = Lux	ω = Humidity Ratio (lb or grains of water/lb of dry air) (g H_2O/kg dry air)

VAV - Single Duct

VAV/

Asset								
Asset Name	**Type**	**Inlet Size**	**Design Max CFM**	**Max CFM**	**Design Min CFM**	**Min CFM**	**Design Heat CFM**	**Heat CFM**
VAV-1	VAV	10"	1250	674	320	322	630	674

Diffuser Supply (GRD)

RTU-3 DIFFUSER/

Asset								
Asset Name	**Location**	**Type**	**Size**	**DESIGN CFM**	**AK**	**CFM(1)**	**FINAL CFM**	**% to design**
3-1	301	A	12	460		239	239	52.0

Asset	Notes
3-1	AHU 3 at full speed

Diffuser Supply (GRD)

VAV-1/301A

Asset								
Asset Name	**Location**	**Type**	**Size**	**DESIGN CFM**	**AK**	**CFM(1)**	**FINAL CFM**	**% to design**
3.1-1	301A	A	12"12"	400		257	257	64.3
3.1-2	301A	A	12"12"	400		166	166	41.5
3.1-3	301A	A	12"12"	400		251	251	62.8

Asset	Notes
3-1	AHU 3 at full speed

Diffuser Supply (GRD)

UVs OA/

Asset										
Asset Name	**Location**	**Type**	**Size**	**DESIGN CFM**	**AK**	**CFM(1)**	**FINAL CFM**	**% to design**	**VEL(1)**	**VEL(2)**
SGRD1	216	duct	14	900	1.07	56	60	56	60	6.7
SGRD2	217	duct	14	900	1.07	112	120	112	120	13.3
SGRD3	223	duct	14	900	1.07	239	256	239	256	28.4

Asset	Notes
3-1	AHU 3 at full speed

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF1 AREA:

Unit Data		
	Design	**Actual**
MFG	GREENHECK	GREENHECK
Model Num	USF-12	USF-12
Serial Num	-	20512849
Type	-	UTILITY SET

Motor Data		
	Design	**Actual**
Motor MFG	-	WEG
Frame	-	56
Horsepower	-	0.25
Motor Rpm	-	1740
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	2.9
Service Factor	-	1.35

Drive Data		
	Design	**Actual**
Motor Sheave Size	-	VL34
Motor Bore Size	-	0.625
Fan Sheave Size	-	AK58
Fan Sheave Bore	-	1.0
Belt CL Distance	-	7.75
Num of Belts	-	1
Belt Size	-	3L280

Test Data		
	Design	**Actual**
CFM	870	456
Fan RPM	1187	1070
RL Voltage	-	118
RL Amperage	-	2.8
Suction ESP	-	0.39
Discharge ESP	-	0.21
Total ESP	0.50	0.60
Brake Horse Power	-	0.24

Completed By: Scott Springer

Notes: NO HORSEPOWER REMAINING TO INCREASE FAN SPEED/CFM

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF2 AREA:

Unit Data		
	Design	**Actual**
MFG	GREENHECK	GREENHECK
Model Num	USF-12	USF-12
Serial Num	-	20512850
Type	-	UTILITY SET

Motor Data		
	Design	**Actual**
Motor MFG	-	WEG
Frame	-	56
Horsepower	-	0.25
Motor Rpm	-	1740
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	2.9
Service Factor	-	1.35

Drive Data		
	Design	**Actual**
Motor Sheave Size	-	VL34
Motor Bore Size	-	0.625
Fan Sheave Size	-	AK58
Fan Sheave Bore	-	1.0
Belt CL Distance	-	7.75
Num of Belts	-	1
Belt Size	-	3L280

Test Data		
	Design	**Actual**
CFM	870	507
Fan RPM	1187	1061
RL Voltage	-	118
RL Amperage	-	2.8
Suction ESP	-	0.38
Discharge ESP	-	0.22
Total ESP	0.50	0.60
Brake Horse Power	-	.24

Completed By: Scott Springer

Notes: NO HORSEPOWER REMAINING TO INCREASE FAN SPEED/CFM

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF3 AREA:

Unit Data		
	Design	**Actual**
MFG	GREENHECK	GREENHECK
Model Num	USF-12	USF-12
Serial Num	-	20512851
Type	-	UTILITY SET

Motor Data		
	Design	**Actual**
Motor MFG	-	WEG
Frame	-	CRE
Horsepower	-	0.25
Motor Rpm	-	1740
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	2.9
Service Factor	-	1.35

Drive Data		
	Design	**Actual**
Motor Sheave Size	-	VL34
Motor Bore Size	-	0.625
Fan Sheave Size	-	AK58
Fan Sheave Bore	-	1.0
Belt CL Distance	-	7.75
Num of Belts	-	1
Belt Size	-	3L280

Test Data		
	Design	**Actual**
CFM	870	482
Fan RPM	1187	1098
RL Voltage	-	118
RL Amperage	-	2.8
Suction ESP	-	0.39
Discharge ESP	-	0.20
Total ESP	0.50	0.59
Brake Horse Power	-	0.24

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Notes:

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF-4 AREA:GENERAL EXHAUST

Unit Data		
	Design	**Actual**
MFG	NA	GREENHECK
Model Num	NA	G-140-VG
Serial Num	-	20518303
Type	-	CRE

Test Data		
	Design	**Actual**
CFM	1300	1348
RL Voltage	-	284
RL Amperage	-	2.0
Total ESP	0.50	0.42

Motor Data		
	Design	**Actual**
Motor MFG	-	VARIGREEN
Horsepower	-	0.50
Motor Rpm	-	300-1750
Phase	-	1
Voltage (rated)	-	277
Amperage (rated)	-	3.2

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Notes:

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF-5 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	GREENHECK
Model Num	NA	SP-A510

Test Data		
	Design	**Actual**
CFM	350	400

Motor Data		
	Design	**Actual**
Horsepower	-	224 W
Motor Rpm	-	1015
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	3.3

Completed By: Scott Springer

Notes:

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF-6 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	GREENHECK
Model Num	NA	SP-A390-VG

Test Data		
	Design	**Actual**
CFM	175	188

Motor Data		
	Design	**Actual**
Horsepower	-	26 W
Motor Rpm	1099	1099
Phase	1	1
Voltage (rated)	115	115
Amperage (rated)	-	1.5

Completed By: Scott Springer

Notes:

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF-7 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	GREENHECK
Model Num	NA	SP-A390-VG

Test Data		
	Design	**Actual**
CFM	175	190

Motor Data		
	Design	**Actual**
Horsepower	-	26 W
Motor Rpm	1099	1099
Phase	1	1
Voltage (rated)	115	115
Amperage (rated)	-	1.5

Completed By: Scott Springer

Notes:

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF-8 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	GREENHECK
Model Num	NA	SP-A90-130-VG

Test Data		
	Design	**Actual**
CFM	129	131

Motor Data		
	Design	**Actual**
Motor MFG	-	Baldor
Horsepower	-	12 W
Motor Rpm	-	1041
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	0.29

Completed By: Scott Springer

Notes:

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF-9 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	GREENHECK
Model Num	NA	SP-A90-130-VG

Test Data		
	Design	**Actual**
CFM	129	132

Motor Data		
	Design	**Actual**
Horsepower	-	12 W
Motor Rpm	-	1041
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	0.29

Completed By: Scott Springer

Notes:

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF-10 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	GREENHECK
Model Num	NA	SP-A90-130-VG

Test Data		
	Design	**Actual**
CFM	129	115

Motor Data		
	Design	**Actual**
Horsepower	-	12 W
Motor Rpm	-	1041
Phase	-	1
Voltage (rated)	-	115
Amperage (rated)	-	0.29

Completed By: Scott Springer

Notes:

National TAB

Project: CMS E.E. Waddell High Reno (Charlotte, NC)

System/Unit: FAN - Exhaust

Comfort. Under control.

Asset: EF-11 AREA:

Unit Data		
	Design	**Actual**
MFG	NA	GREENHECK
Model Num	NA	SP-A90-130-VG

Test Data		
	Design	**Actual**
CFM	129	122

Motor Data		
	Design	**Actual**
Horsepower	-	12 W
Motor Rpm	1041	1041
Phase	1	1
Voltage (rated)	115	115
Amperage (rated)	-	0.29

Completed By: Scott Springer

Notes:

Comfort. Under control.

Diffuser Supply (GRD)

UVs OA/

Asset										
Asset Name	Location	Type	Size	DESIGN CFM	AK	VEL(1)	CFM(1)	VEL(2)	FINAL CFM	% to design
SGRD1	216	duct	14	900	1.07	56	60	56	60	6.7
SGRD2	217	duct	14	900	1.07	112	120	112	120	13.3
SGRD3	223	duct	14	900	1.07	239	256	239	256	28.4